MOTOROLA Service Manual

AUTO RADIO
SUPPLEMENT NO. 1

MODEL
6TAS8

SUPPLEMENT TO 6TAS8 SERVICE MANUAL PART NO. 68P538555

PRODUCTION CHANGES

The following changes have been made to improve the stopping sensitivity in the low and medium sensitivity positions of the sensitivity control:

R-1 has been changed to an 1800 ohm-10%-1/2 watt carbon resistor;

R-2 has been changed to a 470 ohm-10%-1/2 watt carbon resistor.

The following changes have been made to improve the signal-to-noise ratio:

R-13 has been changed to a 2.7 megohm-10%-1/2 watt carbon resistor;

R-14 has been changed to a 22 megohm-10%-1/2 watt carbon resistor.

In later production sets the three-leaf search selector switch E-7 was changed to a single-leaf type. This single-leaf type switch can be used to replace the three-leaf type by removing the ground connection of the switch and the yellow lead from the switch to the Station Finder Foot Pedal Receptacle. Connect the two blue leads to the single connector on the new switch. Muting during search is accomplished by the relay.

REPLACEMENT PARTS LIST SUPPLEMENT

NOTE: When ordering parts, specify model number of set in addition to part number and description or part.

Ref. No.	Part Number	Description	List Price
ELECTRICAL PARTS			
Resistors - Note: All resistors are insulated carbon type unless otherwise specified.			
R-1	6R2089	1800 10% 1/2W.....	.10
R-2	6R6090	470 10% 1/2W.....	.10
R-13	6R488136	2.7 meg 10% 1/2W.....	.10
*R-14	6R488158	22 meg 10% 1/2W.....	.10
*E-7	40A539643	Switch, search: single leaf type.....	.70

PRICES SUBJECT TO CHANGE WITHOUT NOTICE
*New Item, Appears in any List for First Time

SEARCH TUNER 77D537920 (MODEL MST-181)

The balance of this supplement covers information pertaining to the service and operating principles of the Model MST-181 Search Tuner used in Auto Radio Model 6TAS8.

GENERAL INFORMATION

This search tuner is a combination manual tuner coupled to a search drive unit. This system provides two different methods of tuning the radio - manual tuning and search-tuning.

There are two search bars provided for search tuning the radio; a left travel search bar and a right travel search bar. The arrows on the search bars indicate the direction the pointer will travel when one of the search bars is depressed. If no station is tuned in before the pointer reaches either end of the dial scale, the tuner will automatically reverse its direction of travel and search-tune stations in the opposite direction. The search sensitivity control determines the signal strength of stations to which the radio will search-tune.

MANUAL TUNING

The manual tuning shaft (16) is threaded and acts as a power screw which drives the core carriage in a plane parallel to the length of the tuning coils (L-1, L-2, L-3). Because the tuning cores (3) are mounted on the core carriage, they move in or out of the tuning coils (L-1, L-2, L-3) when the tuning shaft (16) is turned. A tuning gear (4) is mounted on the rear end of the tuning shaft (16) and rotates whenever the tuning shaft (16) is turned. As the tuning gear (4) contacts the drive motor's planetary gear system, the planetary gear system will rotate with the tuning shaft (16). Because a search bar has not been depressed,

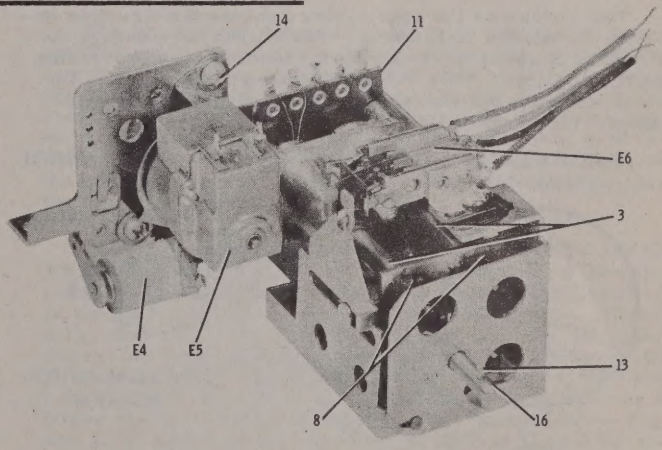


FIGURE 1. MODEL MST-181 SEARCH TUNER

the control clutch does not engage the carrier gear (1); under this condition the planetary gear system is allowed to rotate without turning the drive motor (E5). The power transfer is directly from the manual tuning shaft (16) to the core carriage. (See Figure 2).

SEARCH TUNING

Search tuning provides a way of automatically tuning to the next radio station by depressing a search bar. The mechanism can be operated by either of two search bars; one makes the pointer sweep towards the left-hand side of

MOTOROLA INC. 4545 WEST AUGUSTA BLVD. · CHICAGO 51, ILLINOIS

Part No. 68P538583 Price 10 Cents Printed in U.S.A.

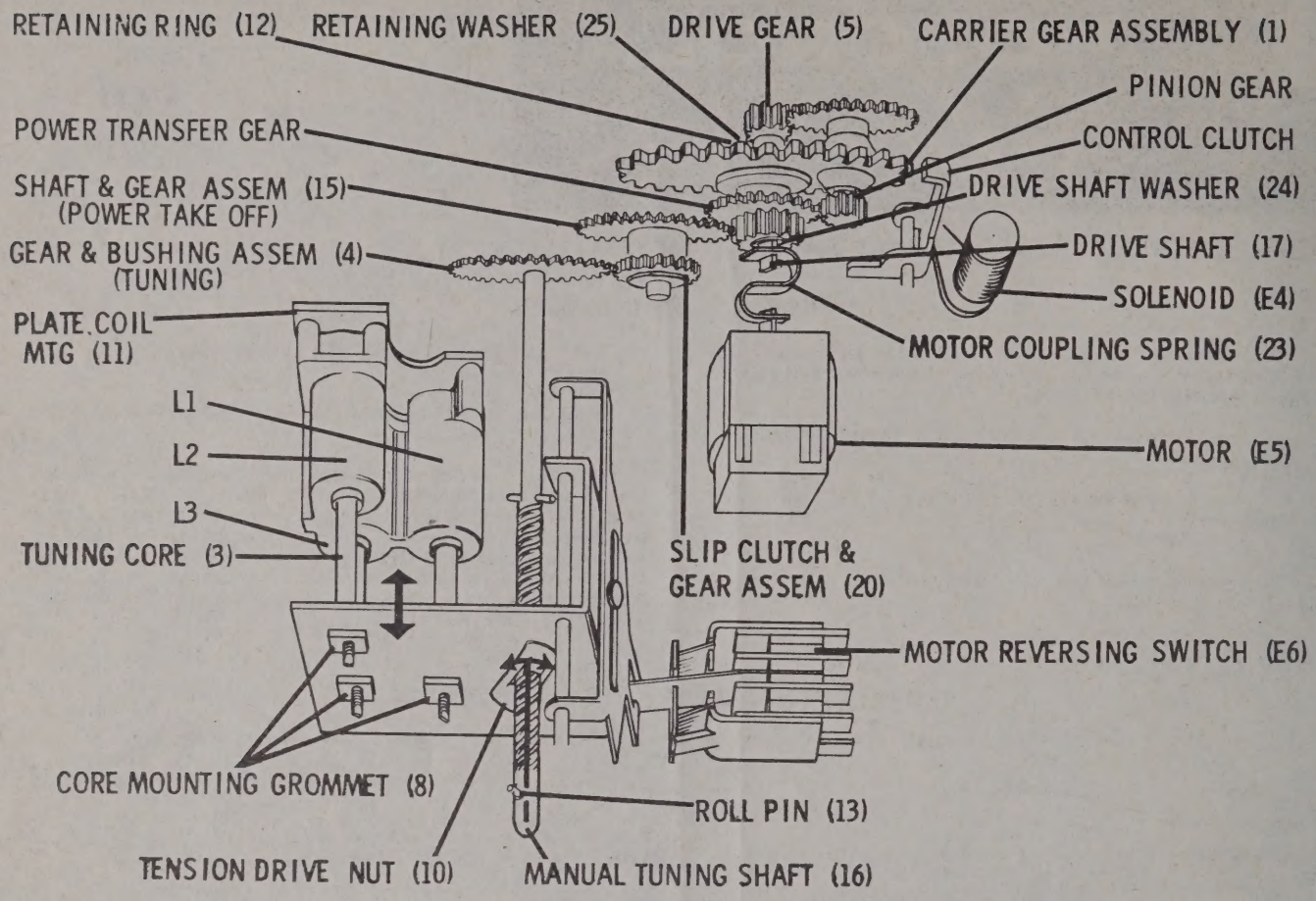


FIGURE 2. MANUAL TUNING

the dial scale; the other bar makes the pointer sweep toward the right-hand side of the dial scale. The search sensitivity control determines the signal strength of stations to which the radio will search-tune.

The arrows on the search bars indicate the direction in which the pointer will sweep. The search bars change the direction of sweep by reversing the position of the reversing switch contacts. This is accomplished by means of a link which connects the search bars to the reversing switch actuator. (See Figure 3).

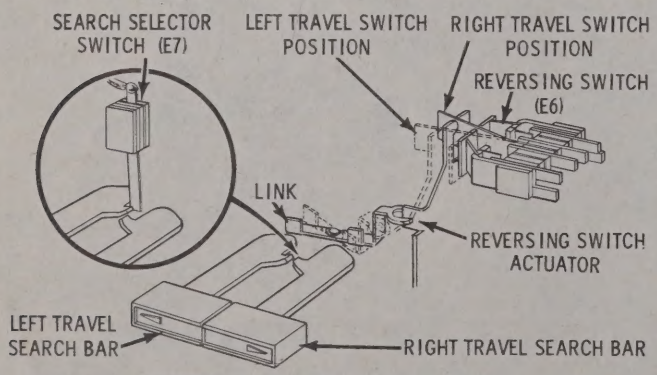


FIGURE 3. SWITCH OPERATION

When operating the radio by means of the search bars, the bars must be fully depressed to insure proper operation of the search-tuning mechanism. If depressed only slightly, there is the possibility of the search selector switch being closed but the motor reversing switch not being tripped. Therefore, it is possible for the tuner to sweep in the direction opposite to that shown on the search bar.

The search sensitivity control determines the signal level of stations to which the radio will search tune. With the control in its high position (high sensitivity), the radio will search-tune to all radio stations within the range of the radio. With the control in its mid-position (medium sensitivity) the radio will search-tune only to strong and medium powered stations. With the control in its low position (low sensitivity), the radio will search-tune only to strong powered stations. The position of the sensitivity control determines the sensitivity level to which the radio will search-tune by altering the amount of input signal applied to the grid of the RF amplifier. The signal strength is altered by changing the Q of the antenna circuit. With the control in its high sensitivity position, capacitor C-2 is switched in parallel to the input capacitor C-1; C-2 compensates for switch capacity. With the control in the medium sensitivity position, resistor R-1 is switched in parallel with the input capacitor C-1, lowering the Q of the input circuit and sensitivity of the radio. With the control in the low sensitivity position, R-2 is switched in parallel to the input capacitor C-1, lowering the Q and sensitivity still further. (See Figure 4). Resistors R-1 and R-2 are connected to a contact of the relay, and are grounded through the contact only when the radio is searching. Therefore, it can be seen that the Q of the antenna circuit is altered only during search.

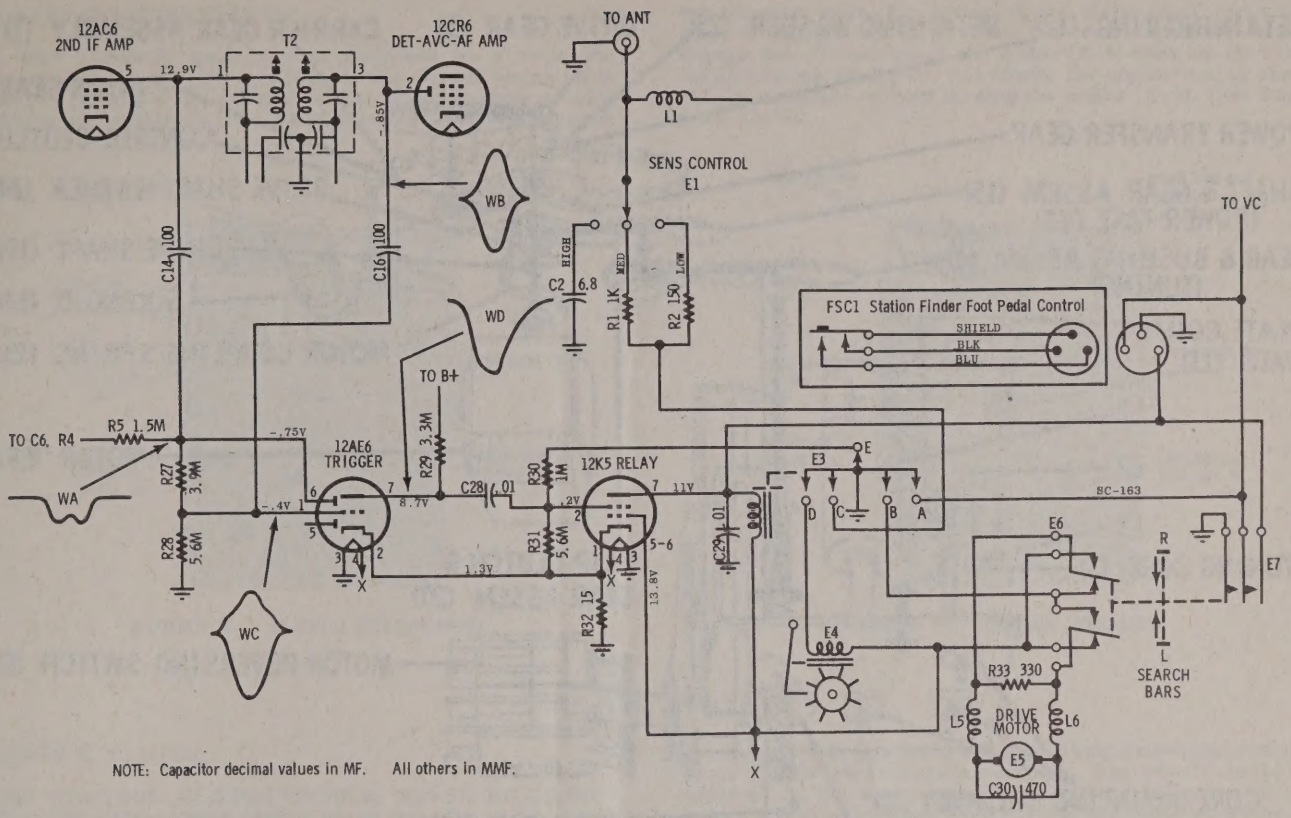
When a search bar is depressed, the following occurs: (see Figure 4)

1. The motor reversing switch (E-6) is tripped to either its left or right travel position (depending on which search bar is depressed) and the search selector switch (E-7) is momentarily closed.

2. With (E-7) momentarily closed, the relay (E-3) circuit is completed to ground. With the circuit completed, relay (E-3) becomes energized and pulls the relay contacts down, grounding contacts A, B, C and D, and ungrounding contact E.

3. Contact A connects to the output stage, and grounding this contact mutes the audio during search.

4. Contact B completes the motor (E-5) circuit to ground, which starts the search mechanism operating. The motor (E-5) is connected to a reversing switch which is tripped by either the position of the core carriage, or by the search



NOTE: Capacitor decimal values in MF. All others in MMF.

FIGURE 4. FUNCTIONAL SCHEMATIC

bars. If the left travel search bar is depressed, the switch will be tripped to its left travel position; if the right travel search bar is depressed, the switch will be tripped to its right travel position. (See Figure 3). This switch is also operated by the core carriage travel. If the radio is sweeping and no station is tuned in before the tuner reaches its end-of-travel position (in either direction), the core carriage will trip the reversing switch (E-6) in the opposite direction.

5. Contact C connects to the gain control resistors R-1 and R-2, and are grounded when the radio is searching, thereby reducing the sensitivity of the input circuit (depending on the position of the sensitivity control), and making the radio less responsive to stations, unless the switch is in high position where sensitivity is not altered.

6. Contact D completes the solenoid (E-4) circuit and energizes the solenoid (E-4). With the solenoid (E-4) energized, the control clutch engages the carrier gear and allows the energized motor (E-5) to drive the tuner by means of the planetary gear system until stopped by an incoming signal. (See Figure 5).

7. Contact E is ungrounded, which ungrounds R-30 and causes the current through the relay tube to increase and hold the relay (E-3) energized until a station is searched.

NOTE: The function of resistor R-30 is to reduce the current flow through the relay tube. Ungrounding this resistor (R-30) increases the current through the relay tube to the point where it is possible to cause relay to clatter. Grounding this resistor (R-30), decreases the relay tube's current to the point where it is insufficient to cause any relay clatter.

8. As the tuner approaches the center frequency of a station, the signal at the grid of the trigger tube becomes more and more positive and develops a negative voltage pulse on the plate of the tube. This pulse is coupled to the grid of the relay tube (which is holding the relay energized) and is of sufficient strength to reduce relay tube's current to the point where it no longer holds the relay contacts down. With the relay contacts in their open position, the search-tuning mechanism is shut off and the tuner is stopped on a station.

The power transfer, while search-tuning, is as follows: (see Figure 5)

From the motor (E-5) to the drive gear (5), from the drive gear (5) to the planetary gear, from the planetary gear to the pinion gear, from the pinion gear to the power transfer gear, from the power transfer gear to the power take-off gear (15), from the power take-off gear (15) to the tuning gear which turns the manual tuning shaft (16) and changes the position of the tuning cores (3).

TRIGGER AND RELAY TUBE FUNCTIONS

The function of the relay tube is to hold the relay energized after the search selector switch has momentarily energized the relay. This is accomplished as follows: When the search selector switch is momentarily depressed, the relay is energized; with the relay energized, the relay contacts are pulled down. With the contacts down, grid resistor R-30 is ungrounded; ungrounding this resistor causes the relay tube to draw a sufficient amount of current to keep the relay energized.

The trigger tube functions as a source of AVC for the RF amplifier stage and as a cut-off device for the relay tube. The coast distance of the tuner after the relay (E-3) is de-energized, is approximately 2.5 kilocycles. Therefore, the relay tube must de-energize the relay (E-3) 2.5 kilocycles before the tuner approaches the center frequency of a station. The trigger tube can actually control the relay tube on the IF signal alone but, because of the difference of power between radio stations, the AVC voltage (WA in Figure 6) is added to the incoming RF (WB in Figure 6), and forms the combined voltage WC. Figure 6 illustrates the addition of the AVC voltage to the RF signal for both a weak station and a strong station. It can be seen that the combined signal (WC) positions the cut-off level approximately 2.5 kilocycles away from the center frequency of the station on both weak stations (by not adding AVC to the incoming signal), and strong stations (by adding AVC to the incoming signal). The combined voltage (WC) is applied to the control grid of the trigger tube and develops a negative voltage pulse WD (See Figure 4 - because of amplification and some rectification) at the plate. This pulse is coupled to the grid of the relay tube and is sufficiently negative to cause the relay tube's current to be lowered to the point where it no longer holds the relay energized. Therefore, this pulse in effect, de-energizes the relay which stops the tuning mechanism on a station.

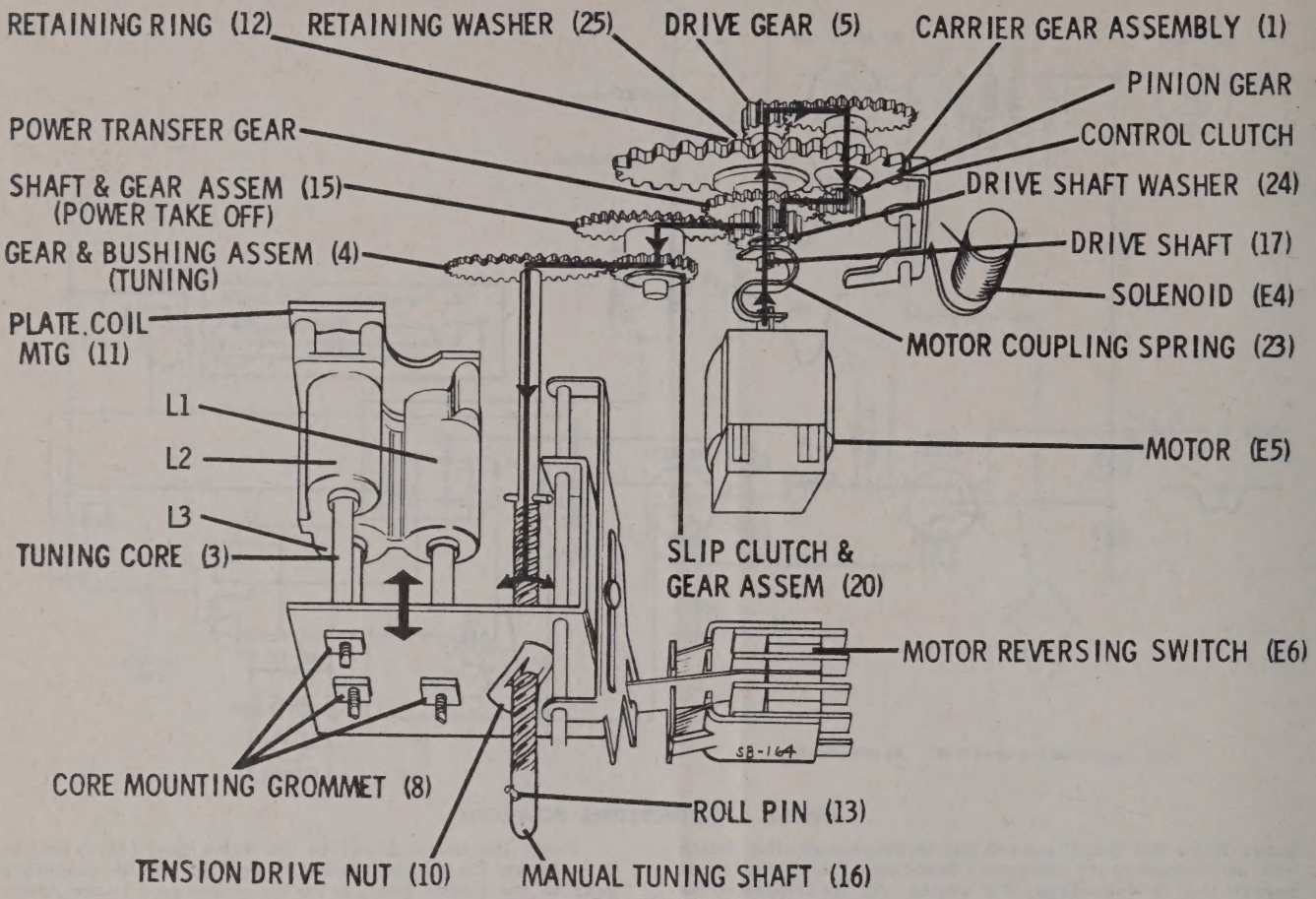


FIGURE 5. SEARCH TUNING

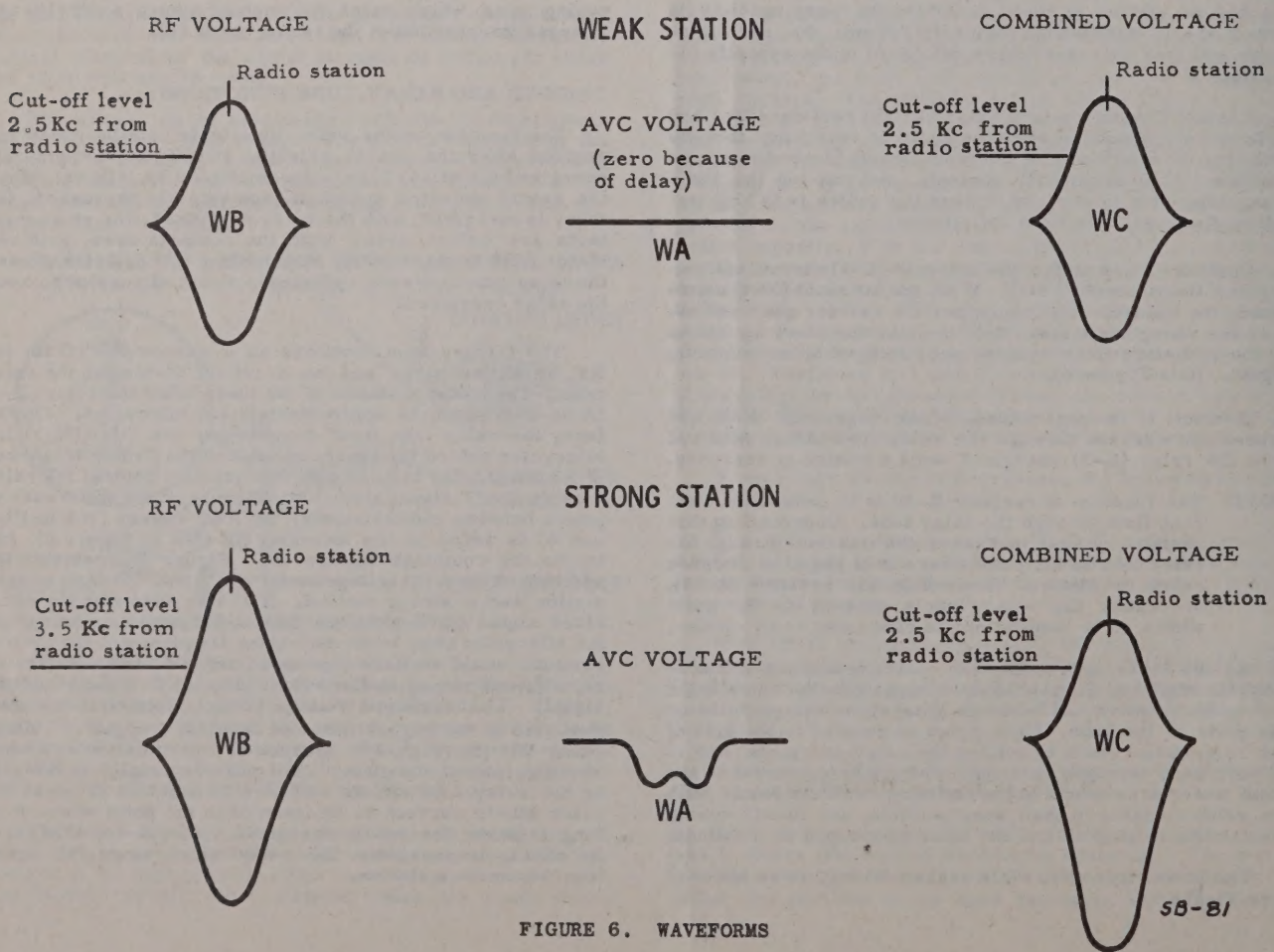


FIGURE 6. WAVEFORMS

PLANETARY GEAR SYSTEM

The planetary gear system functions as a switch to transfer the motor (E-5) power to the manual tuning shaft (16), or to allow the manual tuning shaft to rotate without turning the motor (E-5). When the control clutch engages the carrier gear, the power of the motor (E-5) turns the manual tuning shaft (16). When the control clutch does not engage the carrier gear, the motor (E-5) does not turn the manual tuning shaft (16), but allows the manual tuning shaft (16) to be turned without turning the motor (E-5). (See Figures 7 & 8).

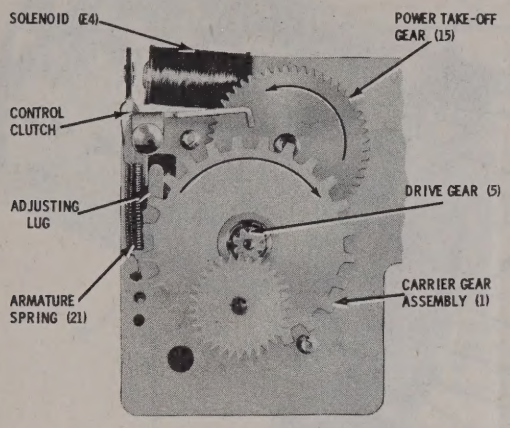


FIGURE 7. CLUTCH DISENGAGED

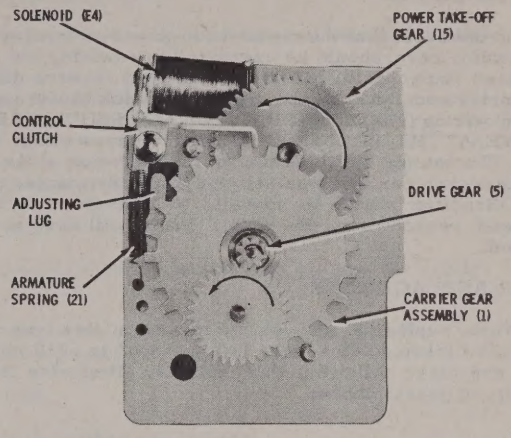


FIGURE 8. CLUTCH ENGAGED

ADJUSTMENTS

CONTROL CLUTCH

THE CONTROL CLUTCH SHOULD NEVER BE OILED - When the control clutch is disengaged from the carrier gear (See Figure 10), the clearance between the tip of the control clutch and the tip of the carrier gear teeth should be no less than .015 inch. This clearance can be adjusted by bending the adjusting lug until the clearance is .015 inch.

CONTROL CLUTCH TENSION SPRING ADJUSTMENT

The control clutch tension spring should apply the maximum amount of tension possible to the control clutch, but allow the clutch to pull-in with 10 volts at the input of the radio. The tension spring is adjusted by means of the three adjusting holes. (See Figure 9). To increase tension, move the spring to a more distant hole; to decrease tension, move the spring to a closer hole.

MOTOR REVERSING SWITCH

There are two adjustments provided for the motor reversing switch; one for the high frequency reversal and the other for the low frequency reversal. The switch should be adjusted so the tuner reverses direction (while searching) before the tuner reaches either of the two tuner stop points.

To adjust the high frequency reversing position, proceed as follows:

Manually trip the reversing switch towards the rear of radio; with the manual tuning knob, tune the radio to the high end stop; turn tuning knob approximately 9° off of the the high end stop (see Figure 10); adjust the high frequency adjusting cam to trip the switch at this point.

To adjust the low frequency reversing position, proceed as follows:

Manually trip reversing switch towards the front of radio; with the manual tuning knob, turn the radio to the low frequency stop; turn tuning knob approximately 9° off of the low frequency stop (See Figure 10); adjust the low frequency adjusting cam to trip the switch at this point.

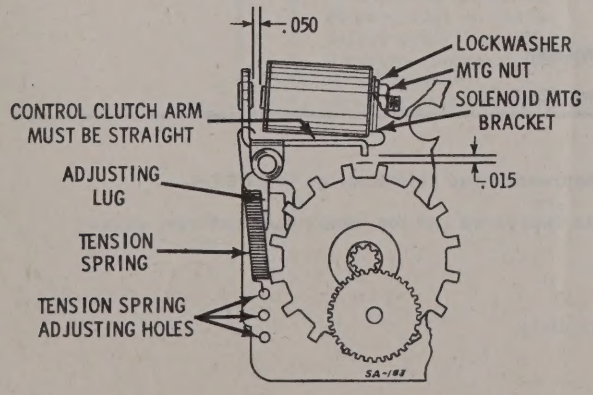


FIGURE 9. CONTROL CLUTCH ADJUSTMENTS

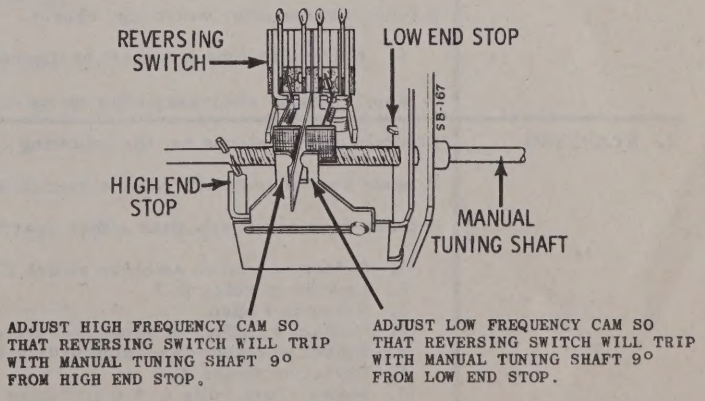

REVERSING SWITCH
LOW END STOP
SB-167
HIGH END STOP
MANUAL TUNING SHAFT
ADJUST HIGH FREQUENCY CAM SO THAT REVERSING SWITCH WILL TRIP WITH MANUAL TUNING SHAFT 9° FROM HIGH END STOP.
ADJUST LOW FREQUENCY CAM SO THAT REVERSING SWITCH WILL TRIP WITH MANUAL TUNING SHAFT 9° FROM LOW END STOP.

FIGURE 10. REVERSING SWITCH ADJUSTMENT

SERVICE NOTES

MOTOR WIRING

In the event that the motor is replaced or unwired from the radio, care should be exercised in rewiring the motor. If wired improperly, the motor will not reverse direction properly, and may cause the tuner to stick at one end. To check wiring (NOTE: INPUT VOLTAGE SHOULD BE POSITIVE AT THE RADIO "A" LEAD), depress either search bar. The pointer should travel in the direction of the arrow on the search bar that was depressed. If the pointer travels in a direction which is opposite to that shown on the depressed search bar, the motor leads will have to be reversed.

GEAR REPLACEMENT

When replacing any of the gears in this tuner, care should be taken so that there is from .003 to .010 inches of free end-play. Allowing this end-play eliminates the possibility of gears binding.

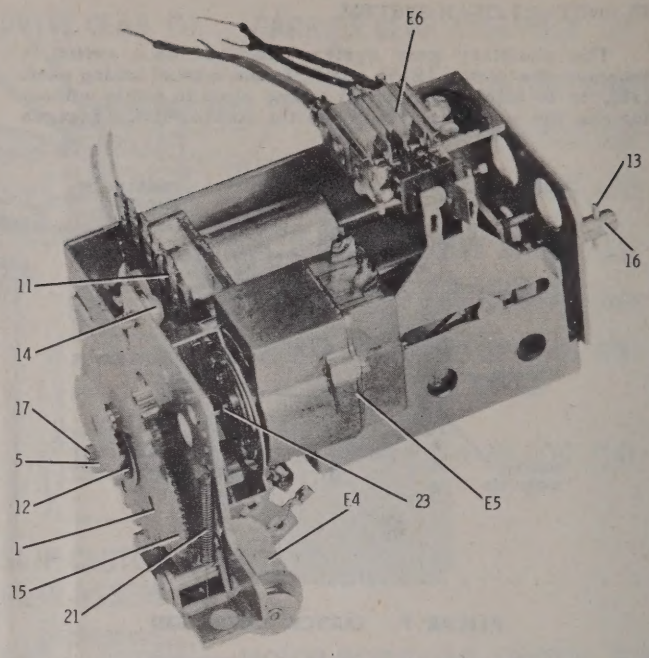


FIGURE 11. TUNER PARTS LOCATION

TROUBLE SHOOTING CHART

This chart covers troubles which may be encountered in servicing the 6TAS8 radio which are caused by the search-tuning mechanism. These problems are divided into four groups:

1. PRELIMINARY for faulty operation when the power is turned on.
2. ERRATIC OPERATION for faulty operation which causes the tuner to sweep erratically.
3. STARTING for faults which cause the tuner to start improperly.
4. STOPPING for faults which cause the tuner to stop improperly.

TEST	INDICATIONS AND INSTRUCTIONS
1. PRELIMINARY	Check tubes. Connect radio to power source as follows: radio "A" lead to positive side; radio housing to negative side. After warm-up, adjust the input voltage to 14.0 volts. If tuner sweeps when power is turned on, check: 1. Defective search selector switch E-7 2. Capacitor C-29 shorted 3. Pins 1 and 7 of 12K5 relay tube for short to ground 4. Switch contacts of relay E-3 defective or dirty 5. Relay E-3 internally shorted If tuner sweeps after warm-up, check: 1. 12K5 relay tube for short to filament or cathode If tuner remains stationary after warm-up, go to TEST 2.
2. STARTING	Disconnect the antenna for the following checks: If tuner sweeps normally after a search bar is depressed and released, go to TEST 4. If tuner does not sweep after either search bar is depressed and the motor does not run, check: 1. Defective search selector switch E-7 2. Low B+ at relay E-3 3. Relay E-3 open 4. Contact switches of relay E-3 defective or dirty 5. Defective motor reversing switch E-6 6. Defective motor E-5 7. Motor choke coils L-5 & L-6 open If tuner sweeps but stops the instant either search bar is depressed and released, check: 1. Defective 12K5 relay tube 2. Resistor R-32 defective 3. Pin 2 of the 12K5 relay tube for a short to ground 4. Defective relay E-3 contacts 5. Defective coupling capacitor C-14

TEST	INDICATIONS AND INSTRUCTIONS
	If tuner does not sweep after either search bar is depressed and the motor does run, check: 1. Motor coupling spring (23) jarred off of motor drive shaft or broken 2. Open or weak solenoid E-4 3. Control clutch bent out of shape or out of adjustment 4. Defective or dirty relay contacts
3. ERRATIC OPERATION	Disconnect the antenna for the following checks: If tuner sweeps to high end and sticks there when operated with either search bar and the motor runs, check: 1. Radio incorrectly connected to the power source (See TEST 1 for proper polarity) 2. Mis-adjustment of motor reversing switch (See ADJUSTMENTS) 3. Mechanical binding of tuner 4. Motor incorrectly wired (See SERVICE NOTES) If tuner sweeps to low end and sticks there when operated with either search bar and the motor runs, check: 1. Radio incorrectly connected to the power source (See TEST 1 for proper polarity) 2. Mis-adjustment of motor reversing switch (See ADJUSTMENTS) 3. Mechanical binding of tuner 4. Motor incorrectly wired (See SERVICE NOTES) If tuner sweeps and sticks at any point midway between either end, check: 1. Tuner for mechanical binding If tuner sweeps exceptionally fast or slow when installed in car, check: 1. Input voltage of radio
4. STOPPING	Connect antenna and make sure that the antenna trimmer is properly adjusted. If tuner sweeps normally it should stop only on strong stations when the sensitivity control is in its minimum position, on strong and medium powered stations with the control in its mid-position, and on all stations within the range of the radio with the control in its maximum position. If the tuner does not stop as above, check: 1. RF, conv, IF and detector tubes 2. Proper adjustment of antenna trimmer 3. Poor or insufficient antenna 4. Low sensitivity 5. 12AE6 trigger tube and 12K5 relay tube defective If tuner stops only on strong stations when operated with either search bar, check: 1. Low sensitivity 2. Proper adjustment of antenna trimmer 3. Poor or insufficient antenna 4. RF, conv, IF and detector tubes 5. Defective IF coupling capacitor C-16 6. Defective 12AE6 trigger tube If tuner sweeps normally but stops either before or after the station, check: 1. Input voltage of radio with radio installed in car 2. Value of bias resistor R-15 3. IF coupling capacitor C-16 for leakage 4. Sticky relay contacts 5. Sticky control clutch 6. Tension spring of control clutch (see ADJUSTMENTS) 7. IF alignment 8. Binding gears in search unit (see SERVICE NOTES)

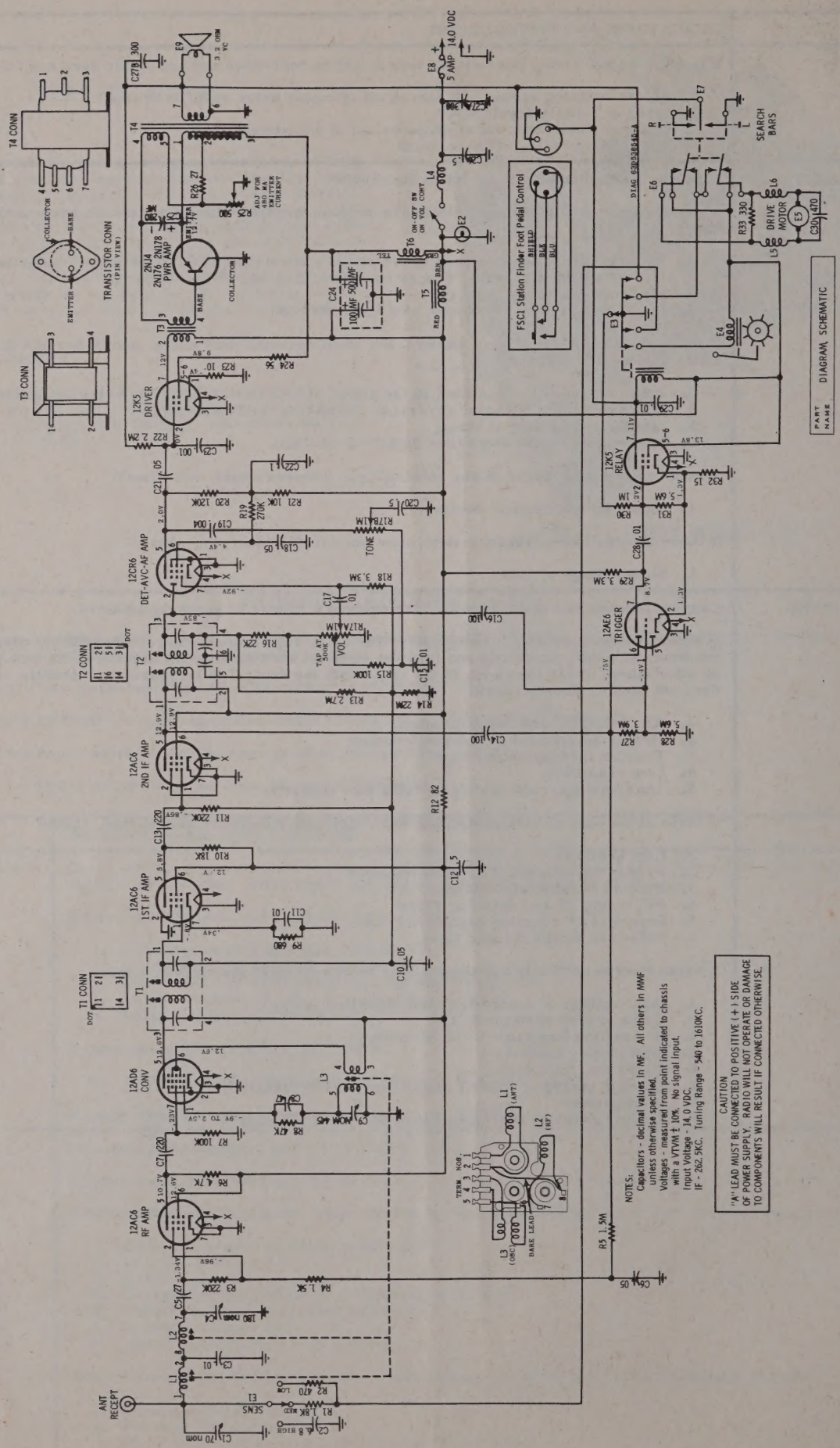

T4 CONN
TRANSISTOR CONN
T3 CONN
T2 CONN
T1 CONN
12K5 DRIVER
12CR6 DET-AVC-AF AMP
12AC6 2ND IF AMP
12AC6 1ST IF AMP
12AD6 CONV
12AC6 RF AMP
12K5 RELAY
12AE6 TRIGGER
FSC1 Station Finder Foot Pedal Control
SEARCH BARS
DRIVE MOTOR
ANT RECEPT
14.0 VDC
NOTES:
Capacitors - decimal values in MF. All others in MMF unless otherwise specified.
Voltages - measured from point indicated to chassis with a VTVM ± 10%. No signal input.
Input Voltage - 14.0 VDC
IF - 262.5KC. Tuning Range - 540 to 1610KC.
CAUTION
"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE OR DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.
PART NAME DIAGRAM, SCHEMATIC

FIGURE 12. REVISED MODEL 6TAS8 SCHEMATIC DIAGRAM